



GCE A LEVEL MARKING SCHEME

SUMMER 2025

**A LEVEL
DESIGN AND TECHNOLOGY – PRODUCT DESIGN
A602U10-1**

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCE A LEVEL DESIGN AND TECHNOLOGY

COMPONENT 1: PRODUCT DESIGN

SUMMER 2025 MARK SCHEME

Question 1

Shown below is an ergonomic computer mouse.

(a) Explain how the design of the computer mouse has been considered, to make it more comfortable for the user. [6]

(b) Explain how improvement in material technology has had an impact on the environmental footprint of the computer mouse shown. [4]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
1. (a)						3	3				6

Candidates should demonstrate knowledge and understanding of technical principles and awarded up to 6 marks. One mark for identifying a feature, and one mark for explaining how the feature improves comfort.

- Anthropometric data has been used to make sure the mouse is a good fit for the majority of users. [1] Designers would have considered the 50th percentile. [1]
- The shape of the mouse means the user's wrist rests in a natural position while using the mouse [1]. This reduces strain and the risk of RSI. [1]
- Edges and contours of the design are shaped to comfortably fit the mouse in the user's hand. [1] Edges have been filleted to avoid sharp corners digging into the palm. [1]
- The buttons for the fingers and thumb are positioned in a natural location [1] meaning they are easy to activate without requiring the user to 'reach' for each button'. [1]
- The roller wheel has been positioned between the index and middle finger so just a small movement is required to move from a button to this. [1] This makes the additional function more comfortable to use. [1]
- The materials are soft to the touch [1] making it easier to use the mouse for extended periods of time. [1]
- Appropriate use of symbols such as the 'forwards' and 'backwards' arrow on the buttons [1] positioned on buttons that make the product easy to use without requiring the user to reach for the button. [1]

Credit any other appropriate response.

1. (b)						2	2				4
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Candidates should demonstrate understanding of technical principles and apply it to specific appropriate points and awarded up to 4 marks.

- Modern materials are often composites which have improved mechanical and physical properties. [1] This means the mouse will require less material to perform the same function when compared to older versions. There is less demand for natural resources. [1]
- Use of components such as smart springs [1] allow for active disassembly which makes it easier to separate the materials making the mouse easier to recycle. [1]
- Improvement in recycling technology means the mouse can now be made from recycled plastics. [1] This helps re-route older products that would otherwise have been sent to landfill. [1]

Credit any other appropriate response.

Question 2

A 3D-printed component for a model cityscape is shown below.

- (a) (i) Calculate the length of the missing side X. [1]
Show all calculations.
- (ii) It takes 7 seconds to print one layer of side A (60mm). Calculate the speed of the print in mm/s. [2]
Show all calculations.
- (iii) The layer height is set to 0.2mm. Calculate how many layers are in the component shown. [2]
Show all calculations.
- (iv) Calculate how long it would take to print the whole component assuming there is only one 'wall', there is no base and 0% infill. [4]
Show all calculations.
- (b) Identify the common faults associated with 3D printers and explain how these can have impact on collaborative design projects. [4]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
2. (a) (i)		✓						1			1
Candidates should demonstrate knowledge and understanding and be awarded up to 1 mark. 70 - 10 = 60mm 1 mark Do not penalise for errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate. Accept any other mathematical method to achieve the final answer.											
2. (a) (ii)		✓						2			2
Candidates should demonstrate understanding and be awarded up to 2 marks based on appropriate mathematical calculations, such as: Speed = distance divided by time 1 mark 60mm / 7 = 8.57 mm/s (allow 8.6 mm/s) 1 mark Do not penalise for errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate. Accept any other mathematical method to achieve the final answer.											
2. (a) (iii)		✓						2			2
Candidates should demonstrate understanding and be awarded up to 2 marks based on appropriate mathematical calculations, such as: Height divided by layer height 1 mark 30mm / 0.2mm = 150 layers 1 mark Do not penalise for errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate. Accept any other mathematical method to achieve the final answer.											

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
2. (a) (iv)		✓						4			4
Candidates should demonstrate understanding and be awarded up to 4 marks based on appropriate mathematical calculations, such as: Calculate perimeter $60 + 70 + 20 + \underline{60} + 40 + 10 = 260\text{mm}$ 1 mark Multiply perimeter by number of layers to find length of print $260 \times 150 = 39,000$ 1 mark Time = distance / speed 1 mark $39,000 / 8.57 = 4,550.75$ seconds or 75.84 minutes 1 mark Do not penalise for errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate. Accept any other mathematical method to achieve the final answer.											
2. (b)									2	2	4
Candidates should demonstrate knowledge and understanding and be awarded up to 4 marks. 1 mark can be awarded for the identification of a common fault, 2 marks for a linked explanation of the impact on collaborative design. Common faults include: Filament jams Parts warping Removal of support material Material shrinkage Over or under extrusion Delays due to filament jam can cause delays, especially if prints have been running through the night. [1] This is because the product will need to be sent for print again and as a result other members of the design team may not be able to progress with their part of the project. [1]. Parts can warp [1] which means testing parts for tolerance can be difficult and unreliable making it difficult for others to work accurately. [1] <i>Credit any other appropriate response.</i>											

Question 3

Shown below is a piece of one-off furniture made from a range of different materials.

- (a) Explain the quality control measures required to ensure accuracy and consistency when manufacturing the table shown as a one-off product. [4]
- (b) Explain how Quality Assurance measures can be used by the manufacturer to ensure the table is delivered to the customer with the intended performance, design and reliability. [4]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
3. (a)	✓								4		4

Candidates should demonstrate knowledge of technical principles and awarded up to 4 marks. 1 mark can be awarded for identifying a QC measure and additional mark/s for explaining how this ensures accuracy and consistency.

Dimensions would be checked against working drawings to make sure they are within the specified tolerance. [1]

Raw or stock materials would be checked for defects before processing. [1]

Use of Jigs, formers and templates would be used to ensure accurate and consistent manufacture of parts. [1]

Visual aesthetic checks would be carried out to look for surface defects. [1]

Use of CAM equipment allows accurate cutting of parts, reducing user error. [1]

Use of tools such as vernier callipers to check dimensions during and after manufacture. [1]

Inspect the surface for visible surface defects, including welding defects or bubbling. [1]

Credit any other appropriate response.

3. (b)	✓								4		4
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Candidates should demonstrate knowledge of design and make principles and awarded up to 4 marks. 1 mark can be awarded for identifying a QA measure, and additional marks for explaining how this ensures the tables' intended performance, design and reliability.

As QA focuses on the processes and procedures that improve quality accept answers that relate to the following:

Materials and sub-assemblies could be sourced from suppliers that have been awarded the ISO 9001 Quality Management Standard. [1]

Ensuring all staff are trained to carry out their tasks to the highest standard, this helps reduce defects and wastage. [1]

Ensuring machines are checked and maintained on a regular basis to make sure blades etc are sharp, guides are accurate etc. [1]

Produce a detailed plan for the QC checks to be carried out, follow and review the plan on a regular basis. [1]

Credit any other appropriate response.

Question 4

The CAD drawing shown below is a side elevation of an architectural model.

- (a) Calculate the area of the regular hexagon aperture for the window. [4]
Show all calculations.
- (b) The quality control check put in place to make sure the window material fits into the aperture is $\pm 0.25\text{mm}$ on the area of the hexagon. Calculate the maximum and minimum size the window can be if it is to pass the quality control check. [2]
Show all calculations.
- (c) The architectural model itself is to be made from laser ply. Suggest a suitable material for the window section and discuss the material characteristics that make it suitable for this application. [4]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
4. (a)		✓						4			4

Candidates should demonstrate understanding and be awarded up to 4 marks based on appropriate mathematical calculations, such as:

Area of isosceles triangle = width x apothem / 2 **1 mark**
 $25 \times 21.65 = 541.25 / 2 = 270.625$ **1 mark**

Area of the regular hexagon = n x width x apothem / 2 **1 mark**
 $6 \times 25 \times 21.65 / 2 = 1623.75\text{mm sq}$ **1 mark**

Do not penalise for errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate.
 Accept any other mathematical method to achieve the final answer.

4. (b)		✓						2			2
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Candidates should demonstrate understanding and be awarded up to 2 marks based on appropriate mathematical calculations, such as:

Maximum = 1624mm^2 **1 mark**
 Minimum = 1623.50mm^2 **1 mark**

Do not penalise for errors carried forward. Continue to award marks if you can clearly see the mathematical method used by the candidate.
 Accept any other mathematical method to achieve the final answer.

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
4. (c)		✓		1				3			4
Award one mark for suitable material and up to three marks for suitable justification based on material characteristics. Suitable materials include: Clear acrylic [1] PETG [1] Acetate film [1] Only award one mark for material identification even if the candidate gives a range of materials. The material is clear and so has similar optical properties to glass, helping to make the architectural model more representative of the final design. [1] The material is easy to cut and shape using workshop equipment, so specialist tools are not required. [1] The material is easy to recycle (not acrylic) so it can be disposed of responsibly once the model has served its purpose. [1] The material takes glue and adhesive well so it can be fixed to the laser ply without the need for mechanical fixings. [1] <i>Credit any other appropriate response.</i>											

Question 5

The image below shows furniture that has been manufactured from an MDF board.

- (a) Explain why MDF is used by some manufacturers to produce flat-pack furniture such as the shelving unit shown. [5]
- (b) Outline the environmental factors that must be considered when using MDF for any form of product manufacture. [6]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
5. (a)										5	5

Candidates should demonstrate knowledge and be awarded up to 5 marks.

MDF comes in large sheets, which makes manufacturing panels and shelves for furniture easy [1] because planks do not need to be glued/planed/sanded before being shaped. [1] MDF has a flat, even and consistent surface which takes paints and finishes well [1], this means products can be finished easily in any number of colours or finishes to appeal to the consumer market. [1]

MDF can be veneered so that it looks like natural timber on the surface [1] which is appealing aesthetically (and possibly functionally) to a great many consumers. [1]

MDF is cheaper than using natural timber [1] which means cost savings can be made for the consumer as the materials are cheaper, and this can be reflected in the RRP. [1]

MDF is easy to work with: cut, shape, form and join [1], reducing manufacturing time and energy, and avoiding complex processes / machinery / equipment. [1]

MDF boards can be purchased in bulk and stored flat [1] so that the manufacturer can benefit from economies of scale. [1]

MDF has equal strength in all directions [1] so that the boards can be used efficiently, without worrying about grain direction. [1]

Assess the work as a whole and credit both diagrams (if included) and notes to explain the concept.

Apply a best fit when awarding marks. Responses may vary in breadth and depth.

Credit any other appropriate response.

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
5. (b)										6	6
Candidates should demonstrate knowledge and understanding of technical principles and be awarded up to 6 marks. MDF has an average lifespan of 15-20 years, therefore does not last as long as some natural timbers as it is less durable. [1] This means products need to be replaced more regularly which has a negative environmental impact through extra transportation, processing, finishing required for new products. [1] It is predominantly made from recycled or waste materials, meaning no new trees are felled to produce it. [1] Where virgin materials are used, they should be sourced responsibly e.g. FSC forests. [1] It is easy to machine using CNC equipment so shapes can easily be tessellated reducing the volume of material needed and the volume of waste material produced. [1] MDF can't be recycled easily as the wood shavings cannot be separated from the resin (urea formaldehyde). Therefore, discarded products either go to landfill or are incinerated. [1] Under current legislation softwood dust, hardwood dust and formaldehyde are considered to be hazardous to health. [1] Therefore appropriate PPE and extraction must be used to protect the workers when manufacturing products in MDF. [1] Accept both negative and positive factors <i>Credit any other appropriate response.</i>											

Question 6

With reference to specific design features, describe and explain how consumer groups can influence the design of a product, such as the electric bicycle shown. [6]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
6.							6				6

Candidates should demonstrate understanding of design and make principles and awarded up to 6 marks.

Look for reference to specific design features on the bicycle and award credit where the design of the feature is linked to influence from a consumer group.

Consumer groups such as *Which?* are independent of any manufacturer so should be free from bias and therefore their opinions and reviews are respected by consumers. [1]
Designers and manufacturers can engage with consumer groups (including focus groups) during the design process to check that their products are fit for purpose and meet the needs of the intended target market. [1] Features such as position of the electric motor, or adjustability of seats or handlebars can be considered features and can be adjusted, adapted or changed in line with feedback [1].

Consumer groups can compare products from several manufacturers, meaning a weakness or flaw in a design, or missing features can be shown in a stark light when compared with direct competitors. [1] Designers and manufacturers will look to make sure their products receive good reviews because they know this has an impact on product sales. This is a consideration when making design decisions. [1]

Consumer groups can put pressure on manufacturers to improve the safety of their products by highlighting faults that cause harm or damage. [1] This includes increased safety features for the batteries, and improved braking systems as these bicycles can reach high speeds. [1]

Consumer groups can lobby governments for changes in law and legislation to improve products to protect consumers. [1]

Credit any other appropriate response.

Question 7

The phone case shown below has been manufactured using carbon fibre reinforced plastic (CFRP)

(a) Evaluate the suitability of carbon fibre reinforced plastic (CFRP) for use in the phone case shown. [6]

(b) Analyse the method of laying-up carbon fibre in terms of the cost of manufacture over traditional plastic phone cases. [6]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1c	2a	2b	2c	
7. (a)				4		2					6

Candidates should show knowledge and understanding, clear evidence of appraisal and/or making judgements and apply this to technical principles to be awarded up to 6 marks.

Indicative responses:

CRFP is expensive, so would only be used to manufacture phone covers for high-end, expensive phones.

Low density and light weight mean the cover, while protecting the phone, does not add a great deal to the overall weight.

CRFP is tough so won't get damaged if dropped and will protect the phone inside from damage.

High strength to weight ratio

Can be formed into a thin profile and still retain properties so that it does not add extra bulk to the phone. This means the original profile, dimensions and features of the phone won't be dulled by the addition of the case.

Can be formed into complex shapes that follow the contours, curves, buttons and camera lenses built into the design of the phone.

Low thermal expansion which means it won't deform if the phone overheats.

Many people find the carbon fibre weave pattern and high-shine finish of a CRFP product appealing, which means consumers are likely to pay a premium for it.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 1a
2	3-4	Good evaluation of the suitability of CFRP for the phone case shown. A sound discussion which appraises and/or makes judgements about the benefits of CFRP. Generally well-considered, relevant issues used as a context for the discussion.	2	Applies a sound knowledge and understanding of technical principles relating to the use of CRFP.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited evaluation of the suitability of CFRP. Little evidence of appraising or making judgements about suitability of CFRP for use in the phone case.	1	Applies a basic knowledge and understanding of technical principles relating to the use of CRFP.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1c	2a	2b	2c	
7. (b)					4	2					6

Candidates should show clear evidence of appraisal and/or making judgements and applying this to technical principles to be awarded up to 6 marks.

Indicative responses:

The CRFP layup process is labour intensive whether the manufacturer uses a wet layup or pre-preg (pre impregnated) process. This added labour adds cost to the manufacture.

There are many more steps involved in the carbon fibre layup process when compared with plastic forming processes such as injection moulding, this increases production time.

Carbon fibre requires curing time which increases the volume of manufacturing space needed and slows the cycle-time of product manufacture.

More waste during the manufacture process as Is not a closed loop manufacturing system, so any waste produced does not go back into the system to be reused, unlike injection moulding.

More post-producing finishing required when compared to processing injection moulded parts. E.g. flashing and excess needs to be cut off by hand as the carbon fibre reinforced plastic is difficult to cut and shape.

Specialist tools and equipment are required as CRFP is difficult to work with meaning high quality tooling needs to be purchased.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1a
2	3-4	Good analysis of the impact CRFP layup has on manufacturing cost. A generally sound discussion, which deconstructs information and provides adequate connections and reasoning. Generally well-considered discussion.	2	Applies a generally sound knowledge and understanding of the impact CRFP layup has on manufacturing cost, with generally well-considered factors identified.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited analysis of the impact CRFP layup has on manufacturing cost. Little evidence of deconstructing information and limited connections are made. Few factors are identified.	1	Applies a basic knowledge and understanding of impact CRFP layup has on manufacturing cost.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 8

Analyse the effectiveness of the five-stage risk assessment to reduce the risk of harm to the consumer when operating the children's buggy shown below, or a similar product. [9]

Q	Science	Maths		AO3		AO4				Total	
				2a	2b	1b	1c	2a	2b		2c
8				6						3	9

Candidates should provide evidence of logical reasoning or deconstructing information and applying this to be awarded up to 9 marks. The focus should be on analysis of the factors, though candidates are expected to apply knowledge and understanding of designing and making principles in the deconstruction of information and discussion.

All five stages of the risk assessment must be covered for the candidate to be awarded 9 marks.

Candidate must address the question context and must explain how the risk assessment reduces risk in order to be awarded 9 marks.

1. Identify the potential risk

- There may be a risk in lifting, folding/unfolding the buggy
- Risk of abrasion from straps securing child in place
- Risk from strangulation from straps
- Risk of entrapment of fingers etc with moving parts
- Strain to back/wrist while manoeuvring the buggy through tight spaces/up curbs etc
- Risk of damage to eyes/skin if child is not protected from UV rays
- Risk of buggy rolling away unintentionally

2. Decide who may be harmed

Both the child and adult could be harmed operating the buggy shown. Look for evidence that the candidate has identified who will be harmed when analysing each of the points given above.

3. Evaluate/assess the risk

The risks evaluated/assessed will link with those identified by the candidate in stage 1 above. Look for evidence of linking to the stated product. e.g.

- Back pain from lifting the buggy into/out of a car if the buggy is too heavy or does not have handles/holding points in suitable places
- Abrasions, marks on neck, shoulders and inside arms/legs from straps if they are not suitable cushioned.
- Risk from strangulation from straps if they are not properly secured.
- Risk of entrapment of fingers etc with moving parts unless mechanisms are covered
- Strain to back/wrist if product is not designed with ergonomics in mind, e.g. suitable handles, appropriate footrest used for tilting buggy.
- Addition of a suitable break would prevent the buggy from rolling away unintentionally.

4. Make a record of the findings

A record of the findings is made through the design/make process and suitable design changes are made. Where risk is still present, and cannot be mitigated entirely, suitable user safety guides are issued for consumers to read and follow when operating the buggy.

5. Review at a set period of time or if there is an accident.

Risk assessment should be reviewed annually as a minimum course of action. Any new hazards or risks which have been identified must be communicated to existing users and mitigated in future designs.

Risk assessments are also reviewed if there is an accident while using the product. In some cases, this may result in a product recall so that faults can be fixed, additional safety features can be added, or in some cases the product replaced entirely.

Credit any other appropriate response.

Band	Marks	AO3 2a	Marks	AO4 2c
3	5-6	Excellent analysis of how the 5-stage risk assessment reduces risk of harm. A thorough discussion, which deconstructs information and demonstrates logical connections and reasoning throughout. Well-considered discussion relating back to product sales.	3	Applies a thorough knowledge and understanding of the 5-stage risk assessment, with well-considered, broad ranging relevant factors identified.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	3-4	Good analysis of how the 5-stage risk assessment reduces risk of harm. A generally sound discussion, which deconstructs information and provides adequate connections and reasoning. Generally well-considered discussion relating back to product sales.	2	Applies a generally sound knowledge and understanding of the 5-stage risk assessment, with generally well-considered factors identified.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited analysis of how the 5-stage risk assessment reduces risk of harm. Little evidence of deconstructing information and limited connections are made. Few factors are identified.	1	Applies a basic knowledge and understanding of the 5-stage risk assessment.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 9

Explain the benefits of copyright protection to a designer when generating new work. [9]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2b	2c	
9							5		4		9

Candidates should demonstrate knowledge and understanding of technical principles and designing and making principles and apply this to be awarded up to 9 marks.

Indicative content:

- A copyright is a type of intellectual property that gives its owner the exclusive right to copy, distribute, adapt, display, and perform a creative work, usually for a limited time.
- Copyright is an automatic right, and the designer is the author and owner of the right from the point at which their design is fixed. There is no government copyright register.
- It protects the designer from others copying, distributing, or profiting from their work without permission.
- It stops others from renting or lending copies of the work
- It stops others from publishing the designers work online.
- It stops others from adapting the designers work (i.e., being substantially derived)
- Copyright is international meaning works must be protected from overseas plagiarism or profiting (the Berne convention)
- Copyright lasts the lifetime of the originator plus 70 years. This means the designer can pass the right on to others in a will.
- Designers can license their work for others to use in order to profit from their work
- Designers can opt to sell their rights
- Designers can register their work with a licensing body (not governmental) who will agree licenses and collect royalties on the designer's behalf.
- The designer has 'moral rights' over the work and has the right to be identified as the author. They also have the right to say how the work can be displayed to ensure they don't think it is derogatory or damaging to their reputation.
- The designer and copyright owner is responsible for defending their copyright material against infringement. The designer can take legal action against anyone who they feel has breached their copyright protection or who has profited from their work without permission.

Credit any other appropriate response.

Band	Marks	AO4 1b and 1c	Marks	AO4 2b and 2c
3	4-5	Demonstrates and applies a thorough knowledge and understanding of technical principles associated with copyright protection. Well-considered, relevant wider issues identified.	3-4	Demonstrates and applies a thorough knowledge and understanding of designing and making principles considering intellectual property theme, drawing upon well-considered, relevant examples.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	2-3	Demonstrates and applies a generally sound knowledge and understanding of technical principles associated with copyright protection. Generally well-considered, relevant issues identified.	2	Demonstrates and applies a generally sound knowledge and understanding of designing and making principles considering the intellectual property theme. Generally well-considered examples are provided.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1	Demonstrates and applies a basic knowledge and understanding of technical principles associated with copyright protection. Few issues are identified.	1	Demonstrates and applies a basic knowledge and understanding of designing and making principles considering the intellectual property theme. Few examples are provided.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		

Question 10

Products such as Mercedes-Benz vehicles are manufactured using a Just-In-Time (JIT) methodology. Explain how JIT affects the unit cost of the final product to the consumer. [12]

Q	Science	Maths		AO3		AO4					Total
				2a	2b	1a	1b	1c	2a	2b	
10					6			6			12

Candidates should provide evidence of either their appraisal and/or making judgements and applying this to be awarded up to 12 marks.

Candidate must discuss how JIT affects cost of the product, rather than just a list of 'features' of JIT manufacturing

Indicative content:

- The vehicles are created to meet the market demand which means there is no overproduction reducing cost to the consumer as the manufacturer does not need to build in fail-safe for vehicles not sold. (JIT manufacturing aims at producing items based on demand. Hence all items produced will be sold. So, no obsolete items in the finished goods section. It helps the organisation to adapt well to any changes in product specification from the market without the fear of having any kind of waste and obsolete stocks.)
- JIT aims at keeping the stock holding to bare minimum leading to much lower inventory cost and much lower storage and warehouse cost, savings are passed on to the consumer.
- Lower inventory means lower investment for the same level of production.
- Minimum inventory at all stages of the supply chain means lesser expiry and lesser wastage for the organisation. This is particularly important as car models approach the end of their shelf-life
- JIT reduces cycle time and response time. Reduced cycle time means a lower manufacturing cost.
- Low inventory means greater efficiency in the manufacturing cycle
- Less storage space needed for stock, no heating, electricity required for this excess storage
- To achieve JIT production, there is a need for very close communication between all the parties involved in the entire supply chain. This increases demand for management and administration staff.
- In JIT, immense focus is on quality of the final product and companies work to achieve "first time right" for all goods - fewer mistakes.
- Delays in deliveries from suppliers can halt production and add cost to a production run. Some companies have logistic contingency plans such as helicopters to help reduce cost and time impact of delivery delays.

Credit any other appropriate response.

Band	Marks	AO3 2b	Marks	AO4 1c
3	5-6	Excellent evaluation of the Just in Time methodology. A thorough discussion, which appraises and/or makes judgements about the impact in costs. Well-considered, relevant wider issues used as a context for the discussion.	5-6	Applies a thorough knowledge and understanding of technical principles related to JIT. Well-considered, relevant wider issues identified.
		There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.		
2	3-4	Good evaluation of the Just in Time methodology. A generally sound discussion, which appraises and/or makes judgements about the impact in costs. Generally well-considered, relevant issues used as a context for the discussion.	3-4	Applies a generally sound knowledge and understanding of technical principles related to JIT. Generally well-considered, relevant issues identified.
		There is a line of reasoning which is generally coherent, mainly relevant and with some evidence and structure.		
1	1-2	Limited evaluation of the Just in Time methodology. Little evidence of appraising or making judgements about the impact in costs. Few issues are identified.	1-2	Applies a basic knowledge and understanding of technical principles related to JIT.
		There is limited evidence of relevant examples or structure.		
	0	No response or work that is worthy of a mark		